PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : **B65D 25/08** | **A1**

(11) International Publication Number: **WO 00/10884**

(43) International Publication Date: 2 March 2000 (02.03.00)

(21) International Application Number: PCT/US99/16886

(22) International Filing Date: 26 July 1999 (26.07.99)

(30) Priority Data:

09/136,199	19 August 1998 (19.08.98)	US
09/205,908	4 December 1998 (04.12.98)	US

(71)(72) Applicant and Inventor: SOANE, David, S. [US/US]; 109 King Avenue, Piedmont, CA 94610 (US).

(72) Inventor: McLUEN, Gary, R.; 1800 Ferry Point, Alameda, CA 94501 (US).

(74) Agent: KUO, Jung-hua; Ritter, Van Pelt and Yi, Suite 205, 4906 El Camino Real, Los Altos, CA 94022 (US).

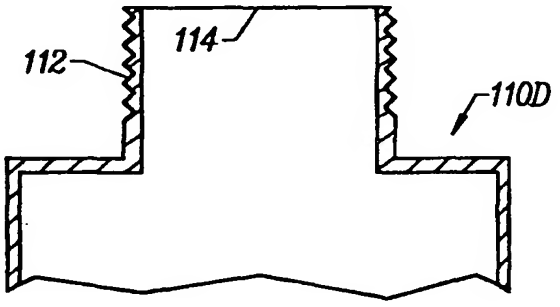
(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, GH, GM, HR, HU, ID, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published
With international search report.

(54) Title: CONTAINER CAP FOR RELEASE OF CONTENTS CONTAINED THEREIN

(57) Abstract

The present invention relates to a container cap (50d) comprising a housing (52d) for containing a quantity of a concentrated material and a cover (54d) which forms an air-tight seal with the housing. The housing (52d) includes a depressible portion (80) with an extension (82) which punctures a wall (58d) of the cover (54d) to release the contents into a container (110d).



FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	**ES**	Spain	**LS**	Lesotho	**SI**	Slovenia
AM	Armenia	**FI**	Finland	**LT**	Lithuania	**SK**	Slovakia
AT	Austria	**FR**	France	**LU**	Luxembourg	**SN**	Senegal
AU	Australia	**GA**	Gabon	**LV**	Latvia	**SZ**	Swaziland
AZ	Azerbaijan	**GB**	United Kingdom	**MC**	Monaco	**TD**	Chad
BA	Bosnia and Herzegovina	**GE**	Georgia	**MD**	Republic of Moldova	**TG**	Togo
BB	Barbados	**GH**	Ghana	**MG**	Madagascar	**TJ**	Tajikistan
BE	Belgium	**GN**	Guinea	**MK**	The former Yugoslav Republic of Macedonia	**TM**	Turkmenistan
BF	Burkina Faso	**GR**	Greece			**TR**	Turkey
BG	Bulgaria	**HU**	Hungary	**ML**	Mali	**TT**	Trinidad and Tobago
BJ	Benin	**IE**	Ireland	**MN**	Mongolia	**UA**	Ukraine
BR	Brazil	**IL**	Israel	**MR**	Mauritania	**UG**	Uganda
BY	Belarus	**IS**	Iceland	**MW**	Malawi	**US**	United States of America
CA	Canada	**IT**	Italy	**MX**	Mexico	**UZ**	Uzbekistan
CF	Central African Republic	**JP**	Japan	**NE**	Niger	**VN**	Viet Nam
CG	Congo	**KE**	Kenya	**NL**	Netherlands	**YU**	Yugoslavia
CH	Switzerland	**KG**	Kyrgyzstan	**NO**	Norway	**ZW**	Zimbabwe
CI	Côte d'Ivoire	**KP**	Democratic People's Republic of Korea	**NZ**	New Zealand		
CM	Cameroon			**PL**	Poland		
CN	China	**KR**	Republic of Korea	**PT**	Portugal		
CU	Cuba	**KZ**	Kazakstan	**RO**	Romania		
CZ	Czech Republic	**LC**	Saint Lucia	**RU**	Russian Federation		
DE	Germany	**LI**	Liechtenstein	**SD**	Sudan		
DK	Denmark	**LK**	Sri Lanka	**SE**	Sweden		
EE	Estonia	**LR**	Liberia	**SG**	Singapore		

BNSDOCID: <WO_____0010884A1_I_>

CONTAINER CAP FOR RELEASE OF CONTENTS CONTAINED THEREIN

CROSS REFERENCE TO RELATED APPLICATION

This is a continuation-in-part application of application Serial No. 09/136,199, filed on August 19, 1998, the entirety of which is incorporated by reference herein.

FIELD OF THE INVENTION

The present invention is a container cap for release of contents contained therein. More particularly, the present invention is a container cap for releasing a volume of fluidic material contained therein approximately simultaneously upon engagement with a container or upon actuation of the container cap.

BACKGROUND OF THE INVENTION

Water comprises a large portion of the weight and volume of most beverages and, as a result, is relatively heavy and bulky to transport, such as from a bottling plant to a local distributor or from the local distributor, such as a supermarket, to the consumer's home. As a result of the weight and volume of the large water content of beverages as well as the high heat capacity of water, much fuel and labor are expended for the transport, storage and/or refrigeration of beverages in bottles and other containers. Thus, cost of such beverages is increased. Therefore, it is desirable to eliminate most of the water content of beverages throughout much if not all of the distribution process to achieve substantial economic savings and increases in environmental friendliness.

Similarly, pre-packaged food items also contain a large portion of water, contributing to their weight, volume and cost. An example of such a pre-packaged food item is ready-to-eat soups in cans, jars or other containers which contain a high water content. Thus, it is also desirable to eliminate most of the water content of such pre-packaged food items containing high water content during most or all of the distribution process.

Certain products such as tea bags and coffee bags have been commercialized in part to reduce the weight and volume by delaying the introduction of water to result in the desired drinks. However, the consumer must wait for the contents of such tea or coffee bags to diffuse and leach through the bags. It is desirable to provide a read-to-drink beverage without substantial increase in the cost and inconvenience associated with transport, storage and/or refrigeration of such high water content beverages by eliminating most of the water content of such beverages during most or all of the distribution process.

Other products such as dried powders have also been commercialized. Examples of such dried powders include instant coffee, powdered milks, powdered dietary or nutritional shakes or drinks, and flavored drinks such as iced teas. However, the consumer must follow a multi-step process of opening the product, measuring a desired amount of the product, pouring the product into another container, filling the container with a suitable volume of water, agitate the mixture to facilitate dissolution of the powder and wait for the powder to dissolve. The conventional packaging techniques described above are time consuming, inconvenient and cannot be easily utilized for carbonated beverages.

Thus, what is needed is a packaging system and technique which reduce the cost and inconvenience associated with the transportation, storage and refrigeration of fluidic consumer products and which can be easily and conveniently prepared by the consumer for consumption.

SUMMARY OF THE INVENTION

The present invention provides a container cap for containing a quantity of a concentrated fluidic or powdery material. The container cap generally comprises a housing for containing the concentrated fluidic or powdery material and a cover which forms an air-tight and fluid-tight or a hermetic seal with the housing for enclosing the fluidic material in the housing. The cover has a member which can be opened to allow the release of the fluidic material contained in the housing. The member may be, for example, a tab or a membrane, which upon breakage, rupture and/or separation, such as from the remainder of the cap, to

BNSDOCID: <WO_____0010884A1_I_>

allow the release of the fluidic material. Additionally or alternatively, the member may be scored to facilitate breakage thereof.

The container cap is preferably engageable with a corresponding container. For example, an interior surface of the housing of the container cap may define threads for engagement with threads provided on an exterior surface at the opening of the container. Of course, any other types of suitable cap-container engagement mechanisms may be utilized, such as a snap-in and lock engagement or a twist and lock engagement typical of child-proof bottle caps.

To release the fluid contained in the container cap into the container, the container may provide a lip for cooperating with the container cap member such that, upon engagement of the cap with the container, the lip engages and opens the container cap member to allow the release of the fluidic material into the container.

Alternatively, the housing may provide a flexible depressible portion depressible from an exterior surface thereof and having an extension extending into the housing from an interior surface of the depressible housing portion. The depressible housing portion may be depressed from its exterior surface such that the extension contacts and punctures or pierces a wall or the member of the cover to allow the release of the fluidic material into the container. The housing preferably defines a flange around the depressible housing portion to prevent or reduce accidental or unintentional puncture of the member.

The depressible housing portion-extension embodiment is more preferred particularly when the contents of the container cap is under pressure, such as in the case of carbonated beverages. Because the depressible housing portion must be depressed in a direction toward the interior of the housing, the contents of the container cap under pressure exert a force on the depressible housing portion in the opposite direction, i.e. toward the exterior of the housing. Thus, the pressurized contents of the container cap further prevent accidental or unintentional puncture of the member.

When reconstitution of the concentrated material contained in the container cap is desired, the consumer may fill a container with a suitable volume

of water at a desired temperature for reconstitution. The instructions for reconstitution may be provided, for example, on the container cap or on a label affixed to the container cap. In the embodiment where the container provides a lip, the engagement of the container cap with the opening of the container approximately simultaneously causes the container lip to engage and open the container cap member, thereby releasing the fluidic material into the water contained in the container. In the embodiment where the housing provides a depressible portion and an extension extending therefrom, after engagement of the container cap with the container, the consumer may depress the depressible housing portion from its exterior surface to cause the extension to contact and puncture the member of the cover. The contents of the container cap are thus released into the container. With either embodiment, the consumer may then shake or otherwise agitate the water and concentrated fluidic material mixture to facilitate mixing thereof.

The present invention may be utilized for non-carbonated drinks such as fruit juices, hot chocolates, various types of milks, iced and hot teas, iced and hot coffees, other caffeinated drinks such as espressos, mochas and lattes, as well as carbonated drinks such as carbonated water and sodas, and alcoholic beverages, non-carbonated and carbonated, such as wines, liquors, beers and stout. For carbonated beverages, the container cap of the present invention may be filled with a beverage concentrate and dry ice comprising carbon dioxide, separately, or with the carbon dioxide already dissolved in the beverage concentrate. With carbonated beverages, an internal pressure equilibrium is reached over time. Further, the dissolution of the gas in a fluid and/or ethanol based concentrate also facilitates the storage of such carbonated contents. The present invention may also be utilized for soups, soup stocks and other food concentrates. Although described in the context of beverages, the container cap of the present invention may be utilized in, for example, pharmaceutical applications such as fluidic drugs and therapeutic agents. Further, the container cap may contain a reactive chemical concentrate which chemically reacts with a diluent contained in the container and the mixture may be utilized or applied shortly after the chemical reaction.

The present invention offers several advantages which include ease of use, decreased packaging and decreased weight and volume, with concurrent reduction in the costs associated with transport, handling, storage, refrigeration and the need to recycle. The consumer may utilize tap, filtered or bottled water or other diluents, at the desired temperature, to mix with the concentrate. Furthermore, because germs generally do not proliferate in syrups, such beverage concentrates are much more difficult to spoil and cause waste and/or health risks. The concentrates are also more readily sterilized and/or pasteurized if such treatments are necessary.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 shows a perspective view of a container and a container cap of the present invention prior to engagement;

FIG. 2 shows a partial cross-sectional view of the container and container cap of **FIG. 1**;

FIG. 3A shows a plane view of the container cap from line **3A-3A** of **FIG. 2**;

FIG. 3B shows a plane view of the container cap of **FIG. 3A** after the member of the container cap has been opened;

FIG. 4 shows a partial cross-sectional view of the container and container cap of **FIGS. 1** and **2** after engagement;

FIG. 5A shows a plane view of a variation of the container cap of the present invention;

FIG. 5B shows a plane view of the container cap of **FIG. 5A** after the member of the container cap has been opened;

FIG. 5C shows a plane view of another variation of the container cap of the present invention;

FIG. 5D shows a plane view of the container cap of **FIG. 5C** after the member of the container cap has been opened;

FIG. 6 shows a partial cross-sectional view of a container and a container cap of the present invention illustrating a variation of the engagement mechanism between the container and the container cap;

FIG. 7 shows a partial cross-sectional view of the container and container cap of **FIG. 6** after engagement;

FIG. 8 shows a perspective view of a container and a container cap of the present invention illustrating a variation of the container lip prior to engagement;

FIG. 9 shows a partial cross-sectional view of the container and the container cap of **FIG. 8** prior to engagement;

FIG. 10 shows a partial cross-sectional view of the container and the container cap of **FIGS. 8** and **9** after engagement;

FIG. 11 shows a cross-sectional view of another variation of the container cap of the present invention;

FIG. 12 shows a perspective view of a container and a container cap of an alternative embodiment of the present invention prior to attachment of the container cap to the container and prior to actuation of the container cap;

FIG. 13 shows a partial cross-sectional view of the container and container cap of **FIG. 12** prior to attachment of the container cap to the container and prior to actuation of the container cap;

FIG. 14 shows a partial cross-sectional view of the container and container cap of **FIG. 12** after attachment of the container cap to the container and during actuation of the container cap by depressing a depressible portion of the container cap;

FIG. 15A shows a plane view of the container cap from line **15A-15A** of **FIG. 13**;

FIG. 15B shows a plane view of the container cap of **FIG. 15A** after the member of the container cap has been opened;

FIG. 16 shows a plane view of a housing of the container cap from line **16-16** of **FIG. 13**;

FIG. 17 shows a cross-sectional view of another variation of a container cap of the present invention prior to actuation;

BNSDOCID: <WO_____0010884A1_I_>

FIG. 18 shows a cross-sectional view of a housing of the container cap of **FIG. 17**; and

FIG. 19 shows a plane view of a housing of the container cap from line **19-19** of **FIG. 18**.

DESCRIPTION OF THE INVENTION

The present invention comprises a container cap for containing a quantity of a concentrated fluidic or powdery material therein. The container cap generally comprises a housing for containing the concentrated fluidic material and a cover which forms an air-tight and fluid-tight or a hermetic seal with the housing for enclosing the fluidic material in the housing. The cover has a member which can be opened to allow the release of the fluidic material contained in the housing. The following description is presented to enable any person skilled in the art to make and use the invention. Descriptions of specific applications are provided only as examples. Various modifications to the preferred embodiment will be readily apparent to those skilled in the art, and the general principles defined herein may be applied to other embodiments and applications without departing from the spirit and scope of the invention. Thus, the present invention is not intended to be limited to the embodiments shown, but is to be accorded the widest scope consistent with the principles and features disclosed herein.

FIGS. 1 and **2** show, respectively, a perspective view and a partial cross-sectional view of a container **110** and a container cap **50** prior to engagement. The container cap **50** generally comprises a housing **52** and a cover **54** for forming an air-tight and fluid-tight seal with the housing **52** such that a quantity of a material, such as a fluidic concentrate, may be enclosed in a volume **56** within housing **52**. The cover **54** includes a member **58** which can be ruptured, pierced, punctured, broken, severed, or otherwise opened to allow the release of the material contained in the volume **56**. The member may be opened by breakage, rupture and/or separation from the remainder of the cover **54** to allow the release of the fluidic material from the volume **56**.

In a currently preferred embodiment, the member **58** may include a scored separation contour **60**, as shown in **FIG. 3A**. In this embodiment, the member **58** may be made of a metallic material, such as aluminum. When a sufficient force is exerted on the member **58** in a direction perpendicular to the member **58** and at a location at or radially interior to the separation contour **60**, a tab **61** is separated from the remainder of the member **58** along the contour **60**. Thus, the opening of the member **58** is approximately contemporaneous with the engagement of the container cap **50** with the container **110**.

The tab **61** formed upon the opening of member **58** is similar to the pull-tab of a can of carbonated beverage. Upon separation of the tab **61** from the remainder of the member **58**, the cover **54** is opened to allow the release of the contents in the volume **56**. Preferably, the separation contour **60** is scored on the surface of member **58** adjacent the volume **56** of housing **52** to reduce risks of unintentional and premature separation of the tab **61** from the remainder of member **58**, particularly when the fluidic material contained in the volume **56** is at a pressure above the ambient pressure. Other provisions known in the art, such as indentations on the surface of the member **58**, may be additionally or alternatively provided to facilitate the opening of the member **58** and/or to reduce risks of unintentional and premature breakage of the member **58**.

For engagement of container cap **50** and container **110**, container cap **50** may provide threads **62** on an interior surface thereof corresponding and engageable with threads **112** defined on an exterior surface of container **110**. Thus, the container cap **50** may be placed upon and rotated relative to the opening **114** of the container **110** to close the opening **114** of container **110**.

The container **110** preferably provides a lip **116** in the shape of a small tapered arc extending from a portion of the perimeter of the opening **114**. When the container cap **50** is rotated until the lip **116** contacts member **58**, the lip **116** is preferably at or radially interior to the separation contour **60**, if one is provided. Continued rotation of the container cap **50** relative to the opening **114** of the container **110** exerts a force on the member **58** in a direction perpendicular to the member **58** and at or radially interior to the separation contour **60**. When a

BNSDOCID: <WO_____0010884A1_I_>

sufficient force is exerted by the lip **116** upon member **58**, the tab **61** is separated from the remainder of the member **58** along the separation contour **60**. Upon separation of the tab **61** from the remainder of the member **58**, the cover **54** is opened and fluidic material contained in volume **56** is released into the container **110**. **FIG. 4** shows a partial cross-sectional view of the container **110** engaged with the container cap **50** and the lip **116** having forced open the member **58**.

Preferably, the housing **52** and the cover **54** form a pressure tight hermetic seal therebetween. Alternatively or additionally, the housing **52** and cover **54** may form an air-tight and fluid-tight seal therebetween by applying an adhesive to, by soldering and/or by melting surfaces of housing **52** and cover **54** which are in contact with each other.

The separation contour **60** of the member **58** may have any number, any suitable configuration, shape, depth and/or any combination thereof. For example, the separation contour **60** may comprise a scored or etched circle or portion of a circle adjacent the perimeter of the member **58** . Examples of variations of the member of the container cap are shown in **FIGS. 5A-5D**, wherein the material of the member is preferably distensible or thinned to allow expansion thereof and separation along the separation contour. **FIG. 5A** shows a container cap **50'** having a member **58'** with four separation lines **60'** which generally intersect at the approximate center of the member **58'**. As shown in **FIG. 5B**, upon separation, breakage or rupture of member **58'** along the separation lines **60'**, member **58'** is opened by being separated into several pieces along the separation lines **60'** to allow the release of the contents in volume **56**.

Another example is shown in **FIGS. 5C** and **5D** wherein a container cap **50''** has a member **58''** with multiple arcuate curves or arcs **60''** located along the circumference of two concentric circular shapes. As shown in **FIG. 5D**, upon separation, breakage or rupture of member **58''** along the separation lines **60''**, member **58''** is opened by having multiple openings at the locations of the separation lines **60''**.

In each of the examples of **FIGS. 5A-5D**, the separation contour **60'** or **60''** may be scored or otherwise provided on either or both surfaces of the

members **58'** or **58''**. Preferably, the separation contour **60'** or **60''** is scored on the surface of the member **58'** or **58''** adjacent the volume of the housing **52**, as described above, to reduce risks of unintentional and premature separation or breakage of the member **58'** or **58''**, particularly when the fluidic material contained in the volume is at a pressure above the ambient pressure. The threading and rotation of the container cap relative to the container opening is such that the force exerted by the lip of the container on the separation contour is maximized because the large axial distance relative to the small vertical distance traversed by the member relative to the lip.

Referring now to **FIGS. 6** and **7**, container cap **50A** and container **110A** are engageable via a snap-in and lock engagement mechanism rather than via threads. Container cap **50A** may provide a circumferential indentation **62A** on an interior surface of cover **54A** corresponding and engageable with a circumferential ring **112A** defined on an exterior surface of container **110A**. Thus, the container cap **50A** may be placed upon and pushed toward the opening **114** of container **110A** a direction indicated by arrow **D**. When a sufficient force is exerted, circumferential indentation **62A** of container cap **50A** will snap around the circumferential ring **112A** of container **110A** to close the opening **114** of container **110A**. As another variation, indentation **62A** of cover **54A** and/or ring **112A** of container **110A** need not extend around the entire circumference but may be portion or portions thereof. Other variations include providing the circumferential indentation on an exterior surface of the container and providing the circumferential ring on an interior surface of the container cap. As is evident, any other suitable types of closure mechanism, such as a twist and lock engagement typical of child-proof bottle caps, may be utilized to engage the container cap with the container.

Referring now to **FIGS. 8-10**, container **110B** may provide an engageable portion such as a circumferential lip **116B** extending around the opening **114**. **FIGS. 8** and **9** show, respectively, a perspective and a partial cross-sectional view of the container **110B** and a container cap **50B** prior to engagement. **FIG. 10** shows a partial cross-sectional view of the container **110B** and a container cap

50B after engagement. The container cap **50B** utilized in conjunction with container **110B** having a circumferential lip **116B** preferably provides a member **58B** which is distensible. The circumferential lip **116B** may be a mere circumferential extension of the container opening **114**.

When the container cap **50B** is continued to be rotated after the circumferential lip **116B** contacts member **58B**, the circumferential lip **116B** exerts a force upon member **58B** in a direction perpendicular to the member **58B**, to cause member **58B** to distend. When a sufficient force is exerted by the circumferential lip **116B** upon member **58B**, the force causes the separation contour or lines (not shown) of the member **58B** to separate, break or rupture along the separation contour to release the fluidic material contained in volume **56** into the container **110B**.

Preferably, the container **110** is transparent or translucent such that the level of the water or other diluent contained therein can be seen. Further, container **110** preferably includes marks **118** for indication to the consumer of the amount of water or diluent level **120**. In addition, although not shown, the container cap **50** and/or container **110** may include ribbings on the curved exterior surface to facilitate rotation thereof relative to each other. Further, container cap **50** preferably includes information such as nutritional, pricing and/or directions for the reconstitution of the fluidic material contained in the volume **56**. Such information may be printed directly on the container cap **50** and/or on a label affixed to the container cap **50**. Alternatively, the container cap **50** may contain a reactive chemical concentrate which chemically reacts with a diluent contained in the container **110** and the mixture may be utilized or applied shortly after the chemical reaction.

FIG. 11 shows another variation of the container cap **50C** of the present invention. In this variation, the housing **52C** of container cap **50C** is affixed to cover **54C** by the provision of cooperating and engageable threads **70, 72** on an interior surface of the housing **52C** and on an exterior surface of the cover **54C**, respectively. By providing threads **70, 72**, a consumer may fill volume **56** with a quantity of the desired fluidic material, for example, when the consumer

purchases concentrate beverages by bulk. Although not shown, container cap **50C** may also provide one or more O-rings to further ensure sealing between the housing **52C** and the cover **54C**.

An interior surface of the cover **54C** may provide a circumferential indentation **62C** on an interior surface of cover **54C** corresponding and engageable with a circumferential ring defined on an exterior surface of container (similar to that shown in **FIGS. 6** and 7). As described, indentation **62C** of cover **54C** and/or the ring of the container need not extend around the entire circumference but may extend around portion or portions thereof. As is evident, any other suitable types of closure mechanism, such as a twist and lock engagement typical of child-proof bottle caps, may be utilized to engage the container cap with the container.

FIGS. 12-16 show yet another variation of a container cap **50D** of the present invention. **FIGS. 12** and 13 show, respectively, a perspective view and a partial cross-sectional view of a container **110D** and the container cap **50D** prior to attachment of the container cap **50D** to the container **110D** and prior to actuation of the container cap **50D**. The container cap **50D** generally comprises a housing **52D** and a cover **54D** for forming an air-tight and fluid-tight seal with the housing **52D** to contain a quantity of a material in a volume **56D** defined by housing **52D**. The cover **54D** includes a member **58D** which can be ruptured or opened to allow the release of the material contained in the volume **56D**.

The housing **52D** comprises a flexible depressible portion **80** and an elongate extension **82** extending into the housing from the depressible portion **80**. As shown in the cross-sectional view of **FIG. 14**, the depressible portion **80** is depressible from an exterior surface thereof such that the extension **82** contacts and punctures, ruptures or pierces member **58D** of cover **54D** to allow the release of the fluidic material contained in volume **56D**.

Although not shown, the depressible portion **80** is preferably convex, i.e. curves outwardly away from the volume **56D**, particularly when the content of volume **56D** is pressurized such as when volume **56D** contains a carbonated beverage concentrate. Alternatively or additionally, the curvature of the

depressible portion **80** may be designed into and formed during manufacturing of the container cap **50D**. The convex configuration of the depressible portion **80** causes the depressible portion **80** to pop or snap inwardly toward volume **56D** upon exertion of a minimum threshold depression force upon the depressible portion **80**. The convex configuration of the depressible portion **80** results in increased travel of extension **82** and increased depression force required to break the member **58D**. Thus, the convex configuration of the depressible portion **80** may reduce accidental actuation of the depressible portion **80**.

To facilitate the puncture of the member **58D**, member **58D** preferably includes separation scores **60D** as shown in the plane view of **FIG. 15A**. As shown in the cross-sectional and plane views of **FIGS. 14** and **15B**, respectively, when the member **58D** is ruptured or punctured by extension **82**, the member **58D** breaks along the separation scores **60D**. Alternatively or additionally, member **58D** may be thinned (not shown) in the area of the contact with the extension **82**. The material in volume **56D** then flows into the container **110D** via the opening **114** of the container **110D**.

Although housing **52D** preferably provides one elongate extension **82** approximately centrally located relative to the depressible portion **80**, housing **52D** may provide any number of elongate extensions located circularly, randomly or in any suitable other arrangement relative to the depressible portion **80**.

Preferably, the separation scores **60D** are disposed on a surface of member **58D** opposite the volume **56D** of housing **52D** such that the separation force applied by the extension **82** for rupturing or puncturing the member **58D** is more efficiently applied on the opposing surface. Thus, having the separation scores **60D** on the surface of member **58D** adjacent the volume **56D** reduces the risks of unintentional and premature rupture of the member **58D** along the separation scores **60D**, particularly when the fluidic material contained in the volume **56D** is at a pressure above the ambient pressure, such as with carbonated beverages.

The housing **52D** preferably defines a flange **84** around the depressible portion **80** to prevent or reduce accidental or unintentional depression of the depressible portion **80**. Thus, the contents of the container cap **50D** can be

released without engagement of the container cap **50D** with the container **110D**. Consequently, the container **110D** may but does not need to provide a lip or other mechanism to cooperate with the container cap **50D** in order to release the contents of the container cap **50D** from volume **56D**.

Similar to the other embodiments, cover **54D** of container cap **50D** may define threads **62** on an interior surface thereof corresponding and engageable with threads **112** defined on an exterior surface of container **110**. Any other suitable mechanism may be provided for engagement between the container cap **50D** with the container **110D**, such as a snap-in and lock engagement mechanism or a twist and lock engagement typical of child-proof bottle caps.

FIG. 16 shows a plane view of the housing **52D** of the container cap **50D** from line **16-16** of **FIG. 13**. As shown, extension **82** extends from an interior surface of the depressible portion **80** and comprises three prongs **86**. The prongs **86** taper toward a point at an end distal to the depressible portion **80** and taper outwardly at an end adjacent the depressible portion **80**. The prongs **86** are preferably spaced at approximately equal arc angles relative to each other. The prongs **86** provide structural integrity to extension **82** and is easily manufacturable using convention techniques such as injection molding. In addition, the prongs **86** themselves do not occupy significant portion of the volume **56D** such that the size of the container cap **50D** can be minimized. Although any suitable number of prongs **86** may be provided, the extension **82** preferably provides three prongs for reasons of structural integrity and manufacturability. The prongs **86** also facilitate the breakage of the member **58D** along the separation scores **60D**. The number and orientation of the prongs **86** may also correspond to the number and orientation of the separation scores **60D** to further facilitate the breakage of the member **58D** along the separation scores **60D**.

FIGS. 17-19 show yet another variation of a container cap **50E** of the present invention. **FIGS. 17** and **18** show, respectively, a cross-sectional view of the container cap **50E** and a cross-sectional view of a housing **52E** of the container cap **50E**. The container cap **50E** generally comprises a housing **52E** and

a cover **54E**. The cover **54E** includes a member **58E** which can be ruptured or opened to allow the release of the material contained in the volume **56E**.

An interior surface of the housing **52E** and an exterior surface of the cover **54E** may define indentations and protrusions **88, 90**, respectively, which cooperate to form an air-tight and fluid-tight seal with the housing **52E** to contain a quantity of a material in a volume **56E** defined by housing **52E**. Preferably, in the undeformed states, the inner diameter of the housing **52E** is greater than the outer diameter of the cover **54E** such that the housing **52E** and the cover **54E** form a pressure tight fit to facilitate the air-tight and fluid-tight seal therebetween. Alternatively or additionally, the housing **52E** and cover **54E** may form an air-tight and fluid-tight seal therebetween by applying an adhesive on, by soldering and/or by melting surfaces of housing **52E** and cover **54E** which are in contact with each other.

The cover **54E** may provide threads **62E** on an interior surface thereof. Threads **62E** correspond and engage with threads provided on an exterior surface of container (not shown). Again, any other suitable mechanism may be provided for engagement between the container cap **50E** with the container, such as a snap-in and lock engagement mechanism or a twist and lock engagement typical of child-proof bottle caps. In this embodiment, cover **54E** is not entirely enclosed by the housing such that the portion of the cover **54E** defining threads **62E** extend outside of the housing **52E**.

Similar to the embodiment shown in **FIGS. 12-16**, the housing **52E** comprises a depressible portion **80'** and an elongate extension **82'** extending into the housing **52E** from the depressible portion **80'**. The depressible portion **80'** is depressible from an exterior surface thereof such that the extension **82'** contacts and punctures or ruptures member **58E** of cover **54E** to allow the release of the fluidic material contained in volume **56E**. Member **58E** may include separation scores and/or be thinned (not shown) to facilitate the puncture or breakage of the member **58E**. The housing **52E** preferably defines a flange **84'** around the depressible portion **80'** to prevent or reduce accidental or unintentional depression of the depressible portion **80'**. In addition, the cover **54E** of container cap **50E**

and/or the container with which the container cap **50E** is to be engaged preferably provides corresponding and engageable threads and/or any other suitable mechanism for engagement between the container cap **50E** and the container (not shown). Examples of such suitable engagement mechanism include a snap-in and lock engagement mechanism and a twist and lock engagement typical of child-proof bottle caps.

FIG. 19 shows a plane view of the housing **52E** of the container cap **50E** from line **19-19** of **FIG. 18**. As shown, extension **82'** extends from an interior surface of the depressible portion **80'** and comprises three prongs **86'**. The prongs **86'** taper toward a point at an end distal to the depressible portion **80'** and taper outwardly at an end adjacent the depressible portion **80'**. The prongs **86'** are preferably spaced at approximately equal 120° arc angles relative to each other. The prongs **86'** provide structural integrity to extension **82'** and is easily manufacturable using convention techniques such as injection molding. Although any suitable number of prongs **86'** may be provided, extension **82'** preferably provides three prongs for reasons of structural integrity and manufacturability. The prongs **86'** also facilitate the breakage of the member **58D'** such as along its separation scores. The number and orientation of the prongs **86'** may also correspond to the number and orientation of the separation scores to further facilitate the breakage of the member **58D'** along the separation scores.

In one preferred embodiment, the housing **52E** is approximately 2.0 inches in diameter, 1.3 inches in height and has a circumferential wall of 0.04 inches in thickness and indentations **88** each 0.125 inches in height. The depressible portion **80'** of the housing **52E** is approximately 0.03 inches in thickness and is preferably rounded in a direction away from the extension **82'** at a radius of approximately 5 inches. The extension **82'** extending from the depressible portion **80'** of the housing **52E** is approximately 1.15 inch in height, 0.66 inches in diameter, 0.04 inches in the thickness of the prongs, and the prongs taper toward the end distal to the depressible portion **80'** at an approximately 10° angle. The prongs may be chamfered at the end distal to the depressible portion **80'**.

In addition, the cover **54E** is approximately 1.91 inches in diameter, 1.8 inches in total height including the portion having threads **62E**, and has a circumferential wall of 0.04 inches in thickness and protrusions **90** each 0.120 inches in height. The portion of cover **54E** below the member **58E** and having the threads **62E** is approximately 0.6 inches in height. The member **58E** has a thickness of approximately 0.015 inches. Preferably, the housing **52E** and the cover **54E** are made of polyethylene.

The depressible housing portion-extension embodiments are more preferred, particularly when the contents of the container cap is under pressure, such as in the case of carbonated beverages. Because the depressible housing portion must be depressed in a direction toward the interior of the housing, the contents of the container cap under pressure exert a force on the depressible housing portion in the opposite direction, i.e. toward the exterior of the housing. Thus, the pressurized contents of the container cap further prevents accidental or unintentional puncture of the member. For example, as shown in **FIGS. 17** and **18**, the depressible portion curves outwardly. The curvature of the depressible portion may generally be due to the pressure of the contents of the container cap exerted onto an interior surface of the depressible portion but may alternatively or additionally be designed into and formed during manufacturing of the container cap.

In any of the embodiments above, the cover and the member may be integrally formed or may be separately formed and then affixed together. The housing, cover, including or excluding the member, and/or the member may be made of any suitable material such as metal and existing food-grade plastics. Examples of existing food-grade plastics include polyolefins (polyethylene, polypropylene and their copolymers with acrylates, methacrylates and esters), plasticized polyvinyl chlorides, nylons, PET (polyethylene terephthalate), PEN (polyethylene naphthalate) and PET-PEN blends. Any of the materials may be strengthened or otherwise varied by one or more layers of an inorganic material such as silicon or aluminum oxide. In addition to plastic and/or metal, the member may comprise any other suitable material such as Mylar, foil or waxed

cardboard paper, whether distensible or not. Further, the container cap may comprise a single layer or a multi-layer material. Preferably, the member of cover can withstand the pressure of the material contained within volume. Further, when the material is carbonated or otherwise pressurized, the member of cover preferably comprises a material which is not gas permeable to prevent the depressurization of the contents in volume.

Further, in any of the depressible housing portion embodiments described above, the container may also provide a lip (such as one similar to lip **116** shown in **FIG. 1**) or other suitable mechanism to cooperate with the container cap in order to facilitated in breaking of the container cap member for release of the contents of the housing volume. For example, upon engagement of the container cap with the container, the lip may engage the member to expand or distend the member toward the extension such that the member is in contact or near contact with the prongs of the extension. Such positioning of the member relative to the extension reduces the required amount of travel and thus the required amount of force necessary to break the member. Alternatively, the container-container cap system may be designed such that upon engagement of the container cap with the container, the lip engages and breaks the member. Thus, the depressible portion and the member are provided only as a redundancy and a safeguard against instances where the lip fails to engage and/or break the member.

The above description of the various container caps illustrates the simplicity and ease of use of the present invention. The simplicity in design and manufacture as well as the ease of use which allow the container cap of the present invention to be adapted for utilization in a wide spectrum of applications.

While specific embodiments of the invention have been described and illustrated, it will be appreciated that modifications can be made to these embodiments without departing from the spirit of the invention. Thus, the invention is intended to be defined in terms of the following claims.

BNSDOCID: <WO_____0010884A1_I_>

WHAT IS CLAIMED IS:

1. A container cap system for closing a container, comprising:

a container cap, the container cap comprising:

a housing having a flexible portion;

a member, the housing and member forming an air-tight and fluid-tight volume to enclose a material therein, and

an elongate extension extending from an interior surface of the flexible portion of the housing and adapted to open the member upon depression of the flexible portion toward said member.

2. The container cap system of claim 1, wherein said member comprises a separation contour on a surface such that the member is opened by breaking along said separation contour upon engagement of the elongate extension with the member.

3. The container cap system of claim 2, wherein the separation contour is selected from the group consisting of a scored separation contour, a scored or etched circle or portion of a circle adjacent the perimeter of the member, a plurality of lines intersecting at approximately the center of the member and a plurality of arcuate curves on a surface of the member.

4. The container cap system of claim 1, wherein the member comprises a meterial selected from the group consisting of metal, plastic, paper, foil, polyolefins including polyethylene, polypropylene and their copolymers with acrylates, methacrylates, and esters, plasticized polyvinyl chlorides, nylons, polyethylene terephthalate (PET), polyethylene naphthalate (PEN) and combinations thereof.

5. The container cap system of claim 1, wherein the housing, member and elongate extension comprise a meterial selected from the group consisting of metal, plastic, paper, foil, polyolefins including polyethylene, polypropylene and their copolymers with acrylates, methacrylates, and esters, plasticized polyvinyl chlorides, nylons, polyethylene terephthalate (PET), polyethylene naphthalate (PEN) and combinations thereof.

6. The container cap system of claim 1, wherein the housing, member and elongate extension are integrally formed.

7. The container cap system of claim 1, wherein the member and the housing are affixed by a soldered joint, an adhesive and/or cooperating and engaging threads to form an air-tight and fluid-tight seal therebetween.

8. The container cap system of claim 1, wherein one of said member and housing defines at least one protrusion and the other of said member and housing defines at least one cooperating indentation such that the protrusion and indentation engage the housing with the member to form said air-tight and fluid-tight volume.

9. The container cap system of claim 1, further comprising the material in the housing, the material being selected from the group consisting of non-carbonated concentrate, a carbonated concentrate, alcoholic concentrate, non-alcoholic concentrate, concentrated therapeutic fluid, a concentrated nutritional fluid, and a reactive chemical concentrate.

10. The container cap system of claim 1, wherein the extension comprises a plurality of prongs disposed about a central axis of said extension.

11. The container cap system of claim 10, wherein the extension comprises three of said prongs.

BNSDOCID: <WO_____0010884A1_I_>

12. The container cap system of claim 1, wherein the extension tapers toward an end distal to said flexible housing portion.

13. The container cap system of claim 1, further comprising a container, the container having an opening engageable with said container cap such that the opening of the container is in communication with the volume of the container cap upon opening of said member.

14. The system of claim 13, wherein each of said container and the container cap defines cooperating threads to engage the container with said at least one of said housing and member.

15. The system of claim 13, wherein said container defines a lip adjacent to said opening such that upon engagement of said container cap with said container, said lip engages said member.

16. The system of claim 15, wherein upon engagement of said lip with said member, said lip opens said member.

17. The system of claim 15, wherein engagement of said lip with said member distends said member toward said elongate extension.

18. A container cap for closing a container having an opening with a lip, the container cap comprising:

a housing engageable with the container to close the opening of the container; and

a member forming an air-tight and fluid-tight seal with the housing to enclose a material in the housing, the member being engageable with the lip of the container opening such that upon engagement of the member with the container lip, the member opens to allow release of the material.

19. The container cap of claim 18, wherein said member comprises a separation contour such that the member is opened by breaking along the contour upon engagement with the lip of the container opening.

20. The container cap of claim 19, wherein the separation contour is selected from the group consisting of a scored separation contour, a scored or etched circle or portion of a circle adjacent the perimeter of the member, a plurality of lines intersecting at approximately the center of the member and a plurality of arcuate curves on a surface of the member.

21. The container cap of claim 18, wherein the member comprises a material selected from the group consisting of metal, plastic, paper, foil, polyolefins including polyethylene, polypropylene and their copolymers with acrylates, methacrylates and esters, plasticized polyvinyl chlorides, nylons, polyethylene terephthalate (PET), polyethylene naphthalate (PEN) and combinations thereof.

22. The container cap of claim 18, wherein the member and the housing are affixed by a soldered joint, an adhesive and/or cooperating and engaging threads to form an air-tight and fluid-tight seal therebetween.

23. The container cap of claim 18 further comprising a material in the housing, the material being a material selected from the group consisting of powdery material, non-carbonated concentrate, carbonated concentrate, alcoholic concentrate, non-alcoholic concentrate, concentrated therapeutic fluid, concentrated nutritional fluid and a reactive chemical concentrate which can chemically react with a diluent.

24. The container cap of claim 18, wherein said housing has a flexible portion and further comprising an elongate extension extending from an interior surface of the flexible portion of the housing and adapted to open the member upon depression of the flexible portion toward said member.

25. The container cap of claim 24, wherein the extension comprises a plurality of prongs disposed about a central axis of said extension.

26. The container cap of claim 25, wherein the extension comprises three of said prongs.

27. The container cap of claim 24, wherein the extension tapers toward an end distal to said flexible housing portion.

28. A container system, comprising:

a container having an engageable portion with an opening; and

a container cap comprising:

a housing for containing a material, the housing being engageable with the opening of the container to close the opening; and

a cover forming a seal with the housing enclosing the material in the housing, the cover being engageable with the engageable portion of the container opening, wherein upon engagement of the cover with the engageable portion of the container opening, the member opens to allow release of the material.

29. The container system of claim 28, wherein said cover comprises a separation contour on a surface of the member such that the cover is opened by breaking along the contour upon engagement with the engageable portion of the container opening.

30. The container system of claim 29, wherein the separation contour is selected from the group consisting of a scored separation contour, a scored or etched circle or portion of a circle adjacent the perimeter of the member, a plurality of lines intersecting at approximately the center of the member and a plurality of arcuate curves on a surface of the member.

31. The container system of claim 28, wherein the member comprises a meterial selected from the group consisting of metal, plastic, paper, foil, polyolefins including polyethylene, polypropylene and their copolymers with acrylates, methacrylates, and esters, plasticized polyvinyl chlorides, nylons, polyethylene terephthalate (PET), polyethylene naphthalate (PEN) and combinations thereof.

32. The container system of claim 28, wherein the cover and the housing are affixed by a soldered joint, an adhesive and/or cooperating and engaging threads to form an air-tight and fluid-tight seal therebetween.

33. The container system of claim 28, wherein each of the container cap housing and the container defines cooperating threads to engage the housing with the container.

34. The container system of claim 28 further comprising the material in the housing, the material being selected from the group consisting of non-carbonated concentrate, a carbonated concentrate, alcoholic concentrate, non-alcoholic concentrate, concentrated therapeutic fluid, a concentrated nutritional fluid, and a reactive chemical concentrate.

35. The container system of claim 28, wherein said housing has a flexible portion and further comprising an elongate extension extending from an interior surface of said flexible portion and adapted to open said cover upon depression of the flexible portion toward said cover.

36. The container system of claim 35, wherein the extension comprises a plurality of prongs disposed about a central axis of said extension.

37. The container system of claim 36, wherein the extension comprises three of said prongs.

38. The container system of claim 35, wherein the extension tapers toward an end distal to said flexible housing portion.

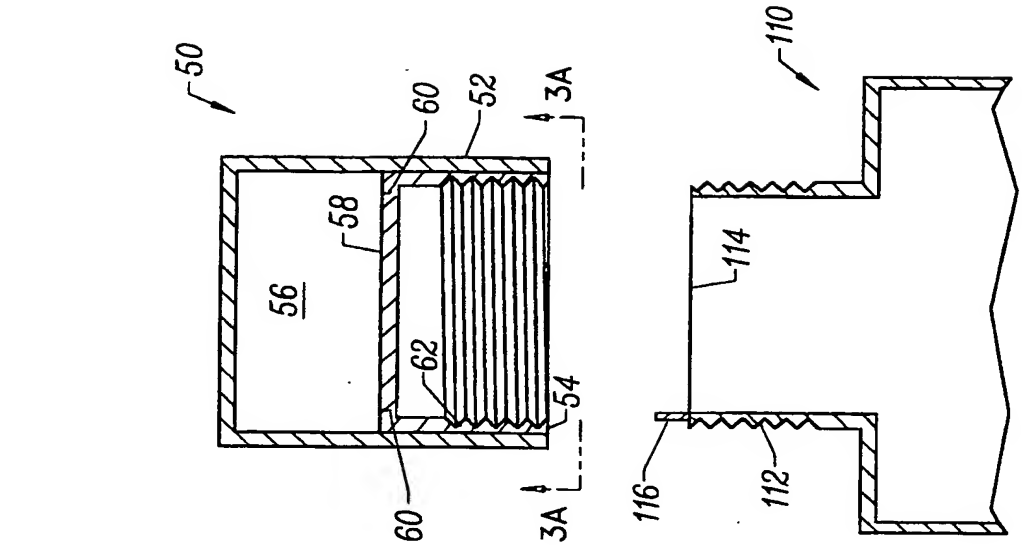


FIG. 2

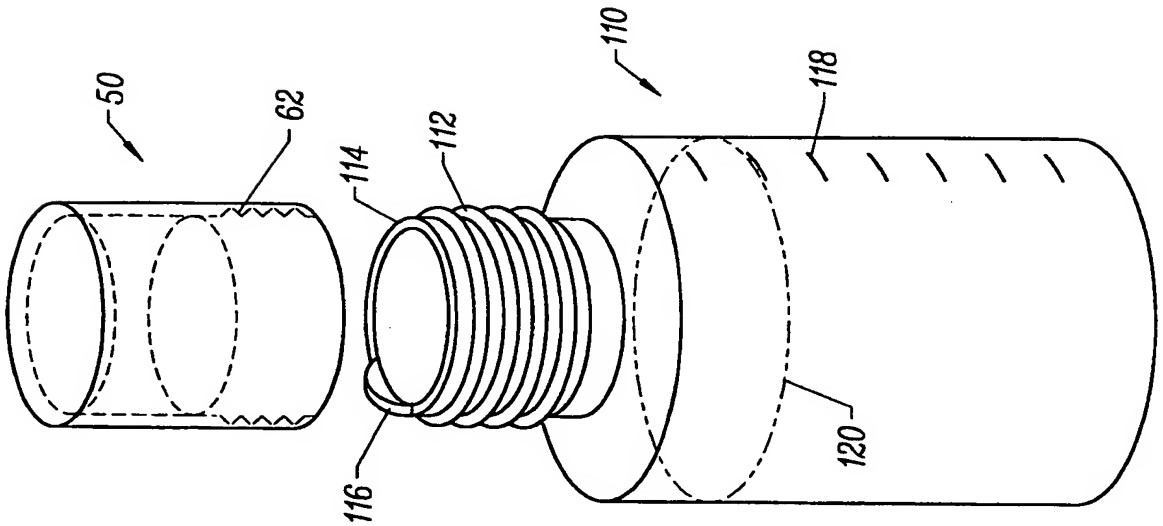


FIG. 1

BNSDOCID: <WO_____0010884A1_I_>

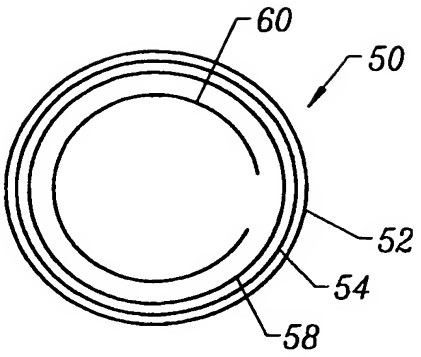


FIG. 3A

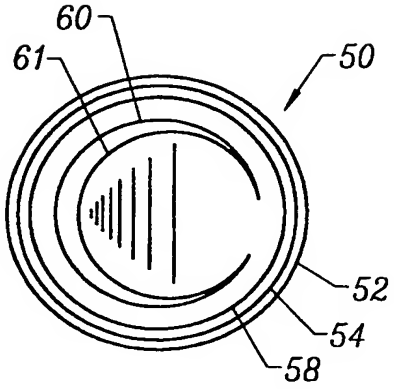


FIG. 3B

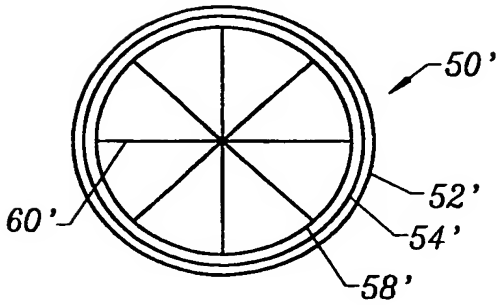


FIG. 5A

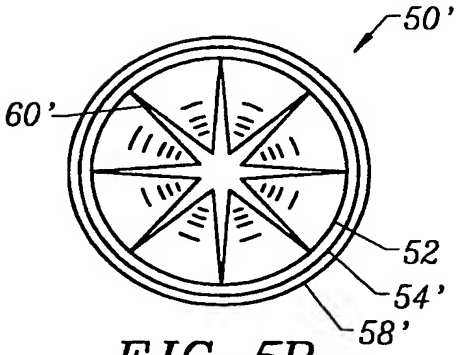


FIG. 5B

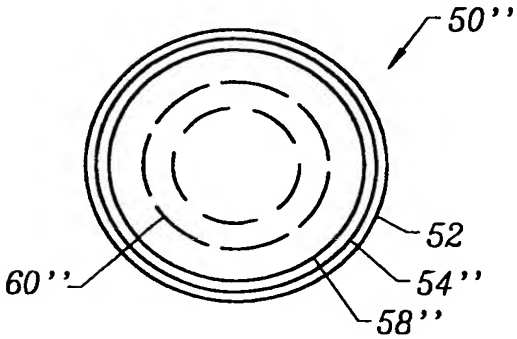


FIG. 5C

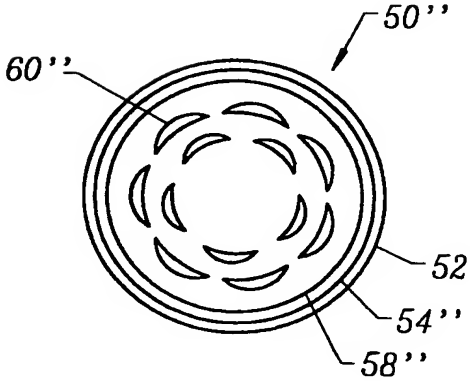


FIG. 5D

BNSDOCID: <WO_____0010884A1_I_>

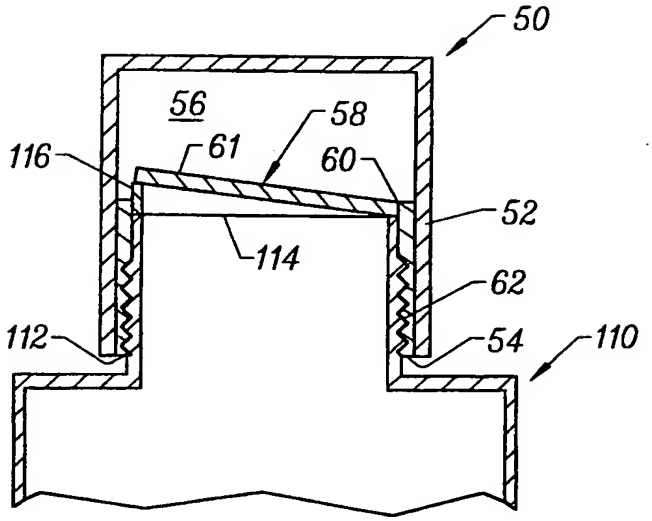


FIG. 4

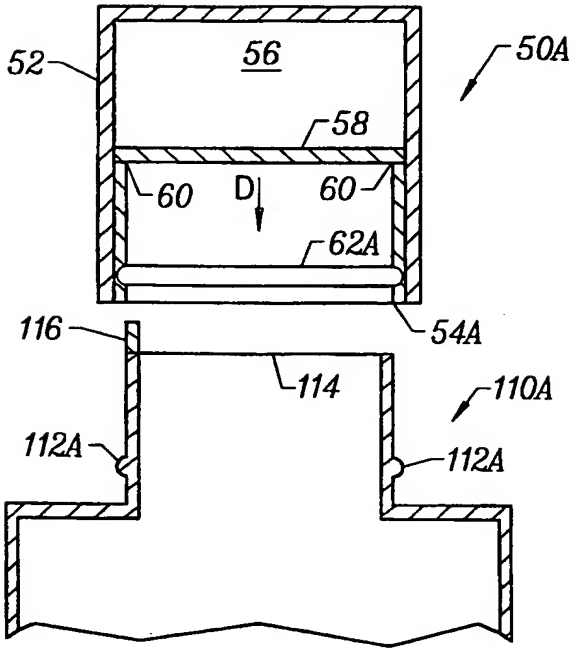


FIG. 6

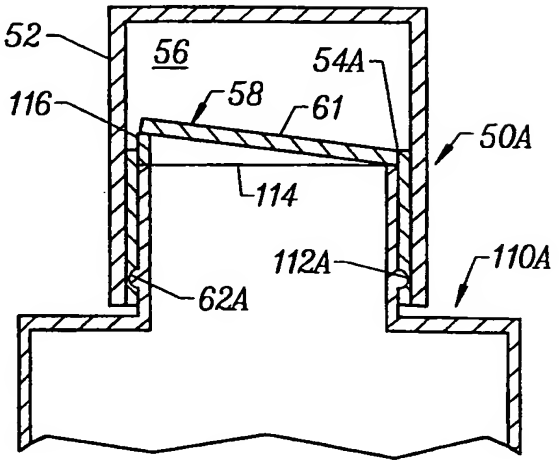


FIG. 7

BNSDOCID: <WO_____0010884A1_I_>

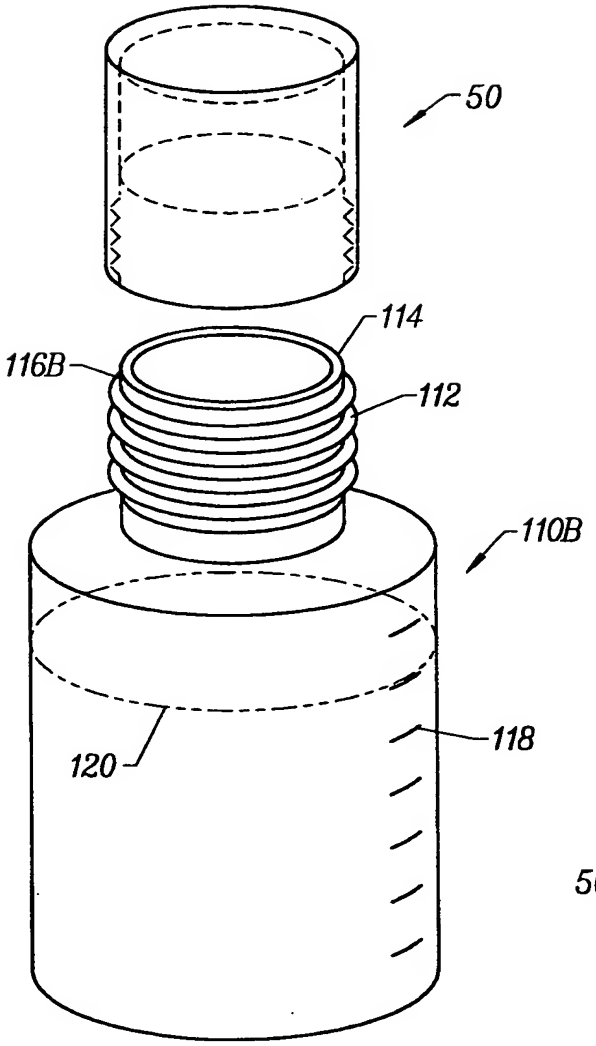


FIG. 8

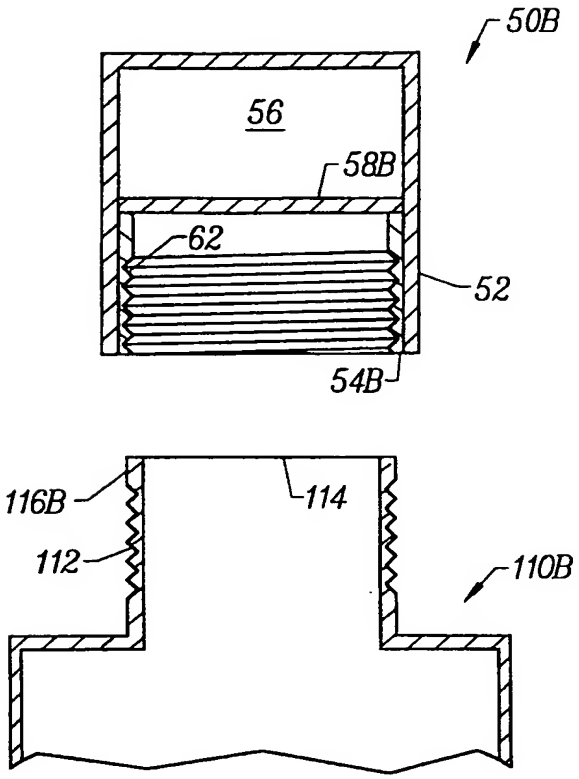


FIG. 9

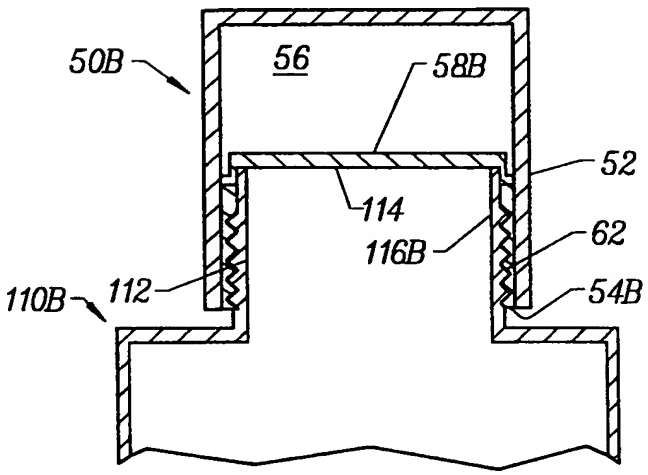


FIG. 10

BNSDOCID: <WO_____0010884A1_I_>

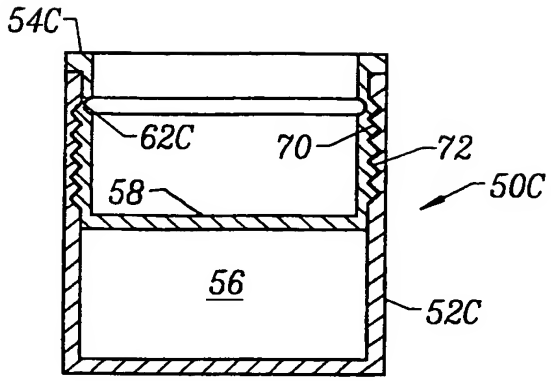


FIG. 11

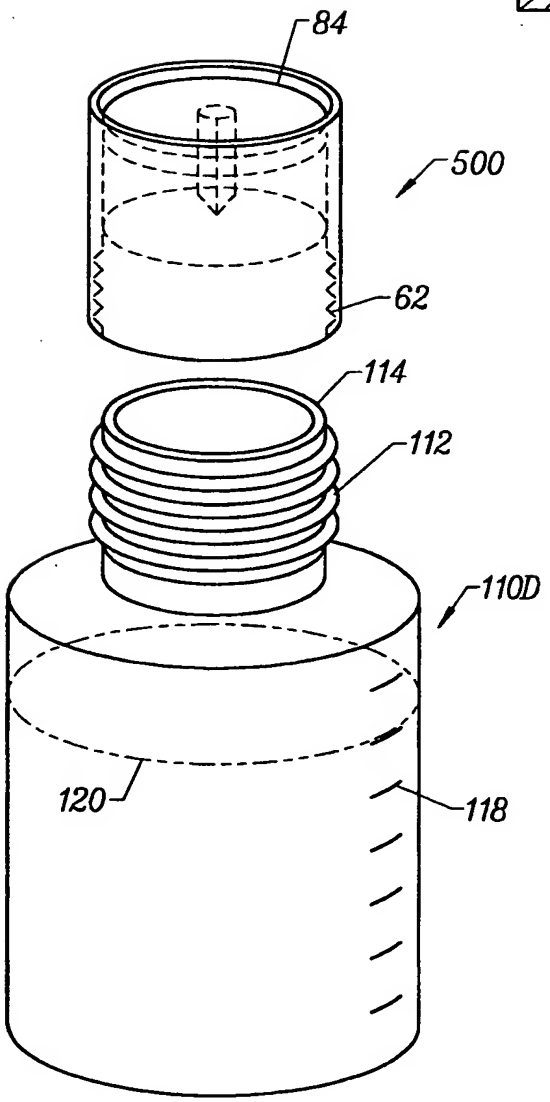
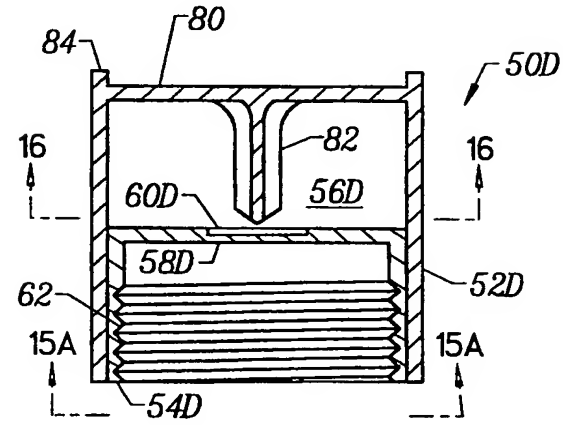


FIG. 12



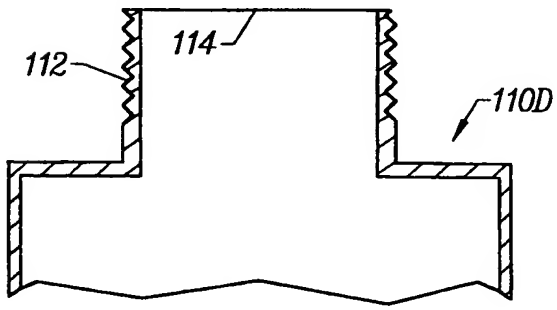


FIG. 13

BNSDOCID: <WO_____0010884A1_I_>

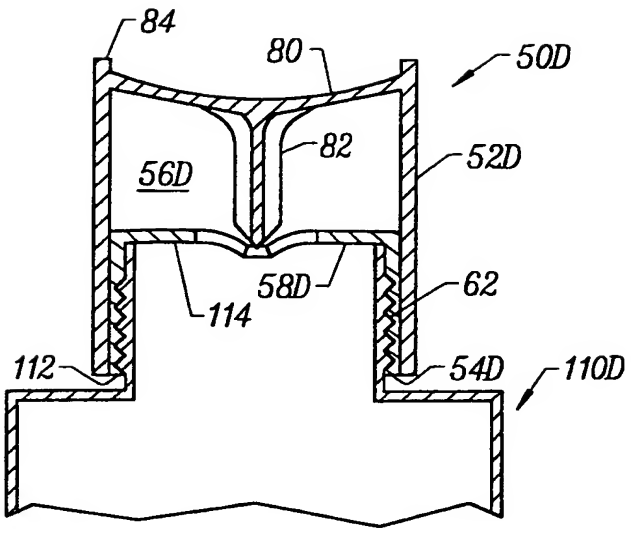


FIG. 14

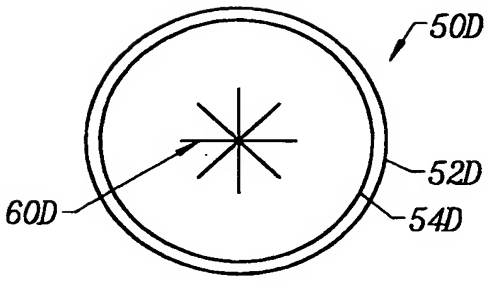


FIG. 15A

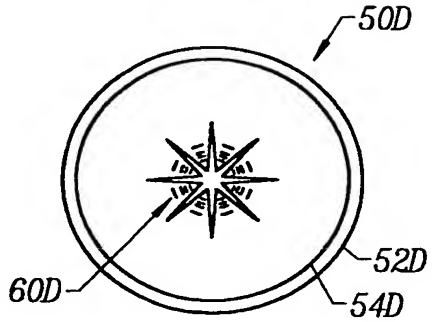


FIG. 15B

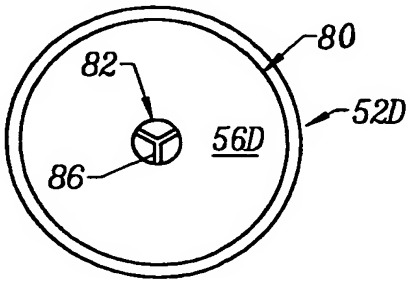


FIG. 16

BNSDOCID: <WO_____0010884A1_I_>

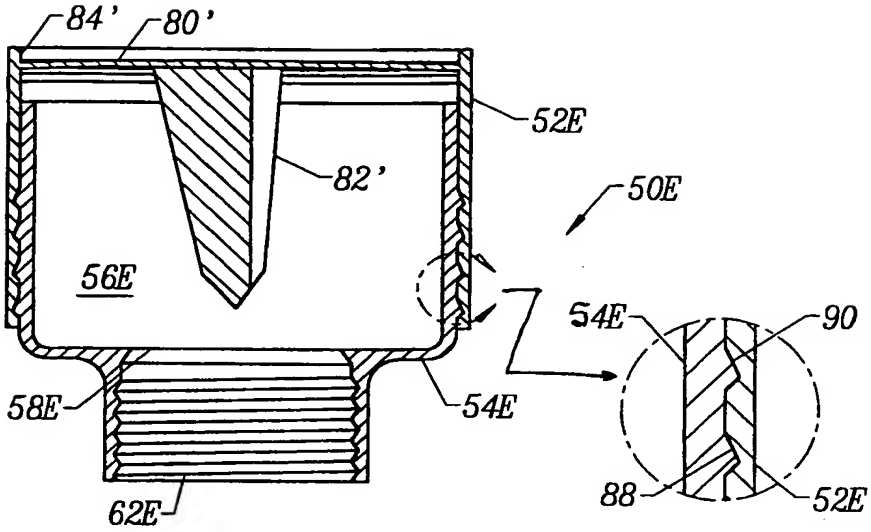


FIG. 17

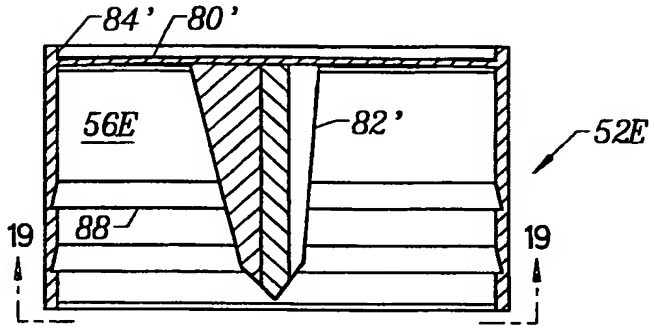


FIG. 18

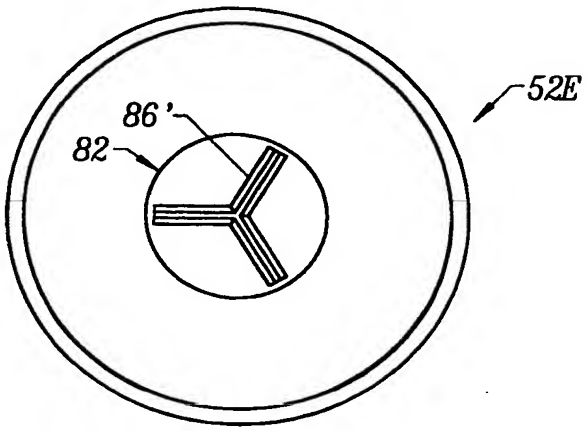


FIG. 19

BNSDOCID: <WO_____0010884A1_I_>

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US99/16886

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) :B65D 25/08
US CL :206/219, 222

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 206/219, 222

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X --- Y	US 2,631,521 A (Atkins, Jr.) 17 March 1953, see figures 1-5.	1, 4-6, 9, 12-18, 21, 23, 24, 27, 28, 31, 33-35, 38 ---------- 2, 3, 19, 20, 29, 30
X --- Y	US 5,255,812 A (Hsu) 26 October 1993, see figures 4 & 5.	1, 4, 5, 7, 10-12, 18, 21-28, 32, 34-38 ---------- 2, 3, 19, 20, 29, 30

[X] Further documents are listed in the continuation of Box C. [ ] See patent family annex.

*	Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A"	document defining the general state of the art which is not considered to be of particular relevance	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E"	earlier document published on or after the international filing date	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&"	document member of the same patent family
"O"	document referring to an oral disclosure, use, exhibition or other means		
"P"	document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search 21 SEPTEMBER 1999	Date of mailing of the international search report 06 OCT 1999
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-3230	Authorized officer DAVID T. FIDEI Telephone No. (703) 308-1220 Sheila Veney Paralegal Specialist Technology Center 3700

Form PCT/ISA/210 (second sheet)(July 1992)*

BNSDOCID: <WO_____0010884A1_I_>

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US99/16886

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X --- Y	US 5,692,644 A (Gueret) 02 December 1997, see figures 1-7.	1, 4, 5, 7-9, 13, 18, 21-24, 28, 31, 34, 35 ----- 2, 3, 19, 20, 29, 30
X --- Y	US 5,370,222 A (Steigerwald et al.) 06 December 1994, see figures 1-6.	1, 4, 5, 7-9, 12-18, 21-23, 28, 31-34 ----- 2, 3, 19, 20, 29, 30
Y	US 3,720,524 A (Nakagami) 13 March 1973, see figure 2.	2, 3, 19, 20, 29, 30
A	US 3,451,540 A (Kulischenko) 24 June 1969.	1
A	US 4,785,931 A (Weir et al.) 22 November 1988.	1

BNSDOCID: <WO_____0010884A1_I_>